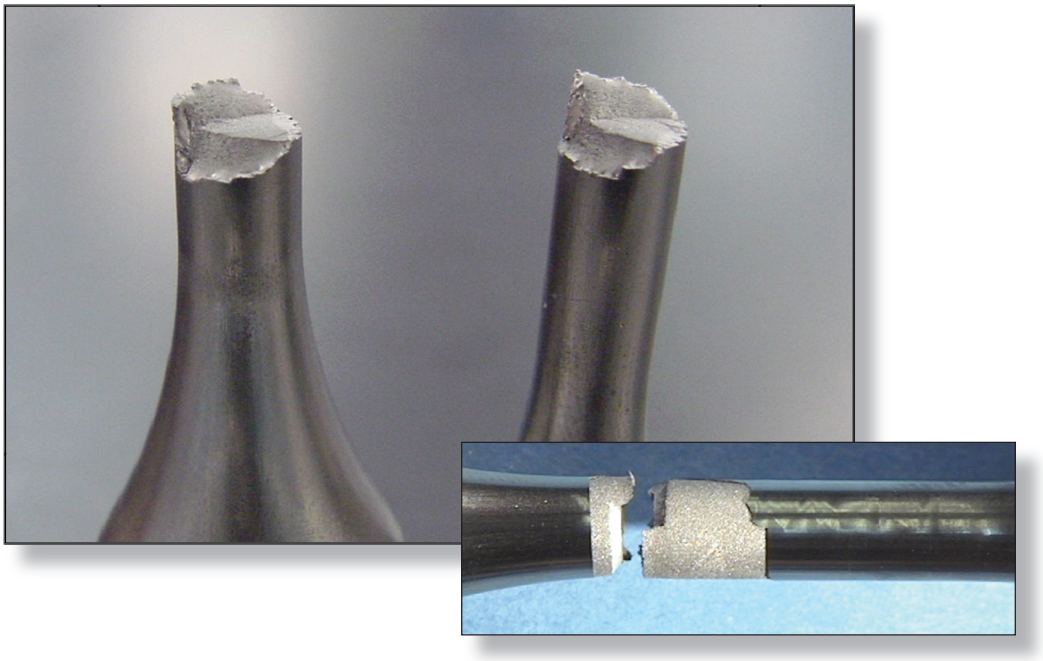
Air Force Research Laboratory|AFRL

Science and Technology for Tomorrow's Air and Space Force

Success Story

MATERIALS AND MANUFACTURING DIRECTORATE ENGINEERS ASSESS COLD SPRAY COATING PROCESSES



Cold spray deposition technologies have demonstrated promise in providing a successful method for applying alternative, environmentally advantaged coatings to aerospace components. Engineers, from the Materials and Manufacturing Directorate's Pollution Prevention Group, and Materials Test and Evaluation Group, conducted a short-term, cost-effective evaluation of five candidate cold spray technologies that ranged from university research studies to commercially available processes.

Due to the favorable results of this initial evaluation, continued testing and validation of the technologies will be conducted. These new tests could yield a solution to environmental compliance, hazardous waste disposal, and worker safety challenges that the Air Force faces with the current electrolytic hard chrome (EHC) coatings and their application processes.

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Accomplishment

Directorate engineers identified two cold spray deposition technologies that may be used to apply tungsten carbide-cobalt (WC-Co) coatings without the spalling and delamination shortcomings associated with high-velocity oxygen fuel (HVOF) thermal-sprayed coatings. If follow-on testing is successful, these technologies have the potential to help the Air Force find a suitable alternative to EHC plating operations, which are plagued by growing environmental compliance and waste disposal problems.

Coating, integrity, and metallurgical evaluations determined that two of the commercial processes successfully provided a WC-Co coating to high-strength steel specimens. Unlike the previously observed performance of HVOF applied coatings, cold sprayed coatings did not spall or delaminate when subjected to stresses in the higher operating range of the substrate material.

Background

EHC plating is used extensively during Air Force Air Logistic Center maintenance operations to rework, rebuild, and repair worn components of aircraft landing gear, hydraulic cylinder actuators, propeller hub assemblies, and gas turbine engines. Chrome plating provides beneficial metallurgical properties such as hardness, wear resistance, corrosion resistance, and lubricity.

However, EHC involves the use of hexavalent chromium, which is a known carcinogen. Federal and state regulatory agencies strictly control its use and disposal, which has resulted in increased disposal costs, increased liability, and risk for the Air Force.

The Air Force and other Department of Defense organizations are currently investigating the use of HVOF thermal spray technology to replace EHC plating. The directorate has conducted several projects involving the demonstration and validation of HVOF thermal spray coatings that have helped to determine the technology's capabilities and limitations.

During directorate testing, engineers determined the ability of each of the cold spray deposition processes to successfully apply WC-Co powder to steel substrates and evaluated the ability of the coating to remain firmly attached when the substrate was subjected to stresses in its higher operating range. An extensive demonstration and validation follow-on project was developed to further evaluate the coatings produced by these two processes.

Materials and Manufacturing
Emerging Technology

Additional information

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